S
363.7394
H2pps
1995

1-c

STATE DOCUMENTS COLLECTION

JUN 0 5 2001

MONTANA STATE LIBRARY
1515 E. 6th AVE.
HELENA, MONTANA 59620

June 1995

Proposed Plan: Streamside Tailings Operable Unit

*By the Montana Department of Health and Environmental Sciences
and the U.S. Environmental Protection Agency*

Agencies Propose Remedy for Streamside Tailings

The Montana Department of Health and Environmental Sciences (MDHES), with concurrence from the U.S. Environmental Protection Agency (EPA), is proposing a plan for the cleanup of the Streamside Tailings Operable Unit (SST OU) of the Silver Bow Creek/Butte Area (original portion) Superfund site. The SST OU includes Silver Bow Creek and adjacent areas from Butte to the Warm Springs Ponds (see Figure 1).

The agencies' identification of the proposed remedy is the culmination of a remedial investigation and feasibility study (RI/FS) conducted by the Atlantic Richfield Company (ARCO) under an administrative order on consent between MDHES and ARCO. MDHES is the lead agency for the SST OU.

MDHES and EPA request public comment on the proposed plan, the alternatives considered, and the supporting documentation in the administrative record. The objective of the proposed plan is to facilitate public participation in the remedy selection process. The proposed remedy identified in this document is an initial recommendation. Changes in the proposed remedy may be made if public comment or additional information indicate such a change would result in a more appropriate remedy for the site.

Community Role In The Selection Process

Public Comment Period	There will be a 60-day comment period from June 9, 1995, through August 7, 1995.
Public Meeting/Hearing	Fairmont Hot Springs Resort at 7 p.m. on July 10, 1995.
Written Comments	Send to Jim Ford, State Project Officer, MDHES, PO Box 200901, Helena, MT 59620-0901.
Informational Meetings to discuss the proposed plan will be held at the following locations:	**Fairmont** - Fairmont Hot Springs Resort, Pintlar Room, at 7 p.m. on June 20. **Butte** - Butte Community Center at 25 West Front Street at 7 p.m. on June 21. **Missoula** - Room 201, Courthouse Annex at 200 West Broadway at 7 p.m. on June 22.

Printed on Recycled Paper

95-17325

MONTANA STATE LIBRARY
3 0864 0016 3390 1

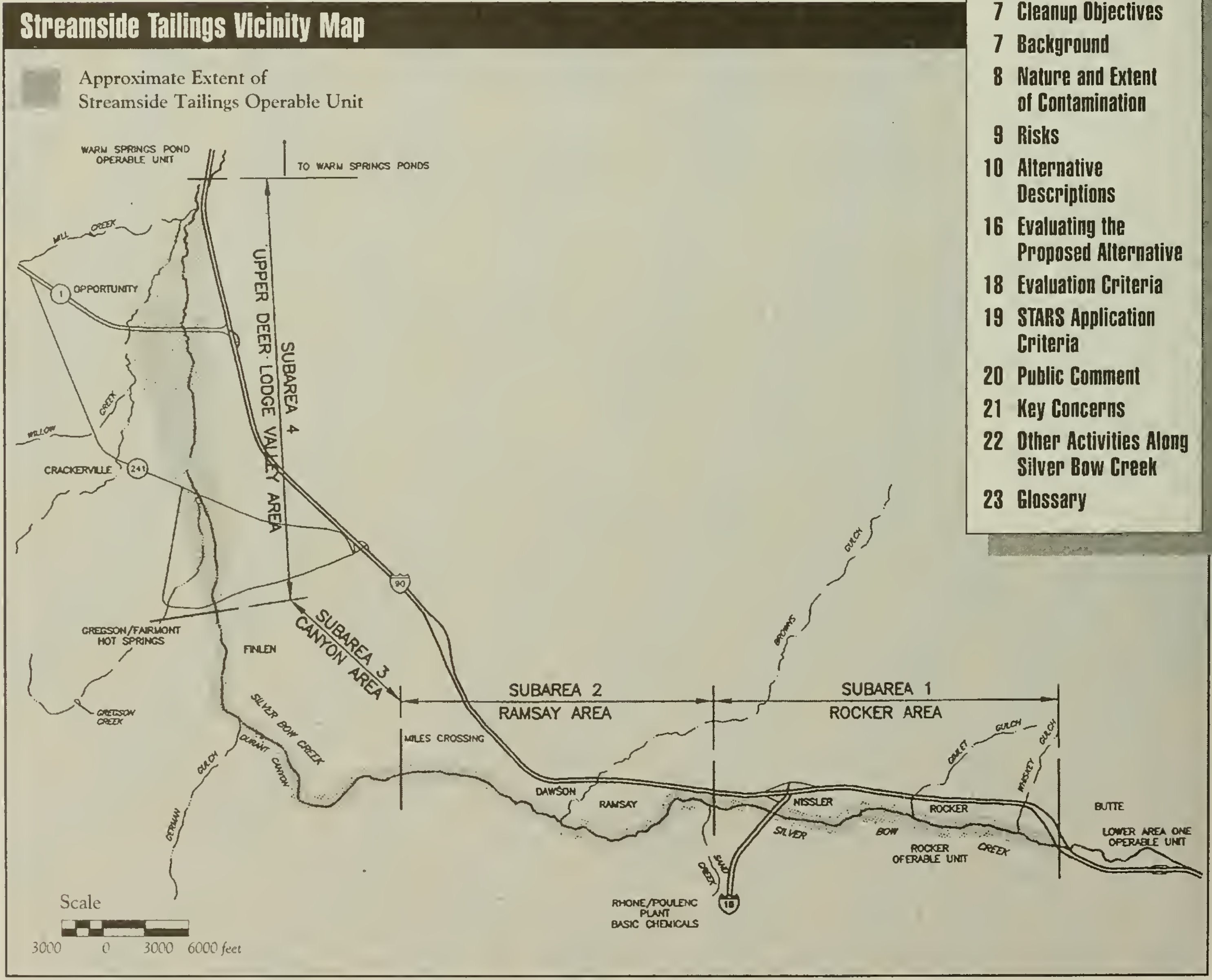
In this Proposed Plan, MDHES and EPA Will:

- Identify the proposed remedy and explain the reasons the agencies are proposing that alternative;
- Outline the various alternatives that were evaluated and compared for the SST OU;
- Highlight key information in the Streamside Tailings Remedial Investigation (RI), Baseline Risk Assessment (BRA), and administrative record;
- Seek public review and comment on the agencies' proposed remedy, the alternatives considered, and the supporting RI/Feasibility Study (FS) documents;
- Provide information on how the public can continue to be involved in the remedy selection process;
- Fulfill public notice requirements outlined in section 117(a) of the Comprehensive Environmental Response, Compensation and Liability Act, as amended (CERCLA or "Superfund"), and the National Contingency Plan (NCP), 40 CFR Part 300, section 300.430(e).

Contents

2 Site Map
3 Proposed Remedy
7 Cleanup Objectives
7 Background
8 Nature and Extent of Contamination
9 Risks
10 Alternative Descriptions
16 Evaluating the Proposed Alternative
18 Evaluation Criteria
19 STARS Application Criteria
20 Public Comment
21 Key Concerns
22 Other Activities Along Silver Bow Creek
23 Glossary

Figure 1


Streamside Tailings Vicinity Map

NOTICE

**THE SUPERFUND HOTLINE AS IT
APPEARS ON PAGE 9
IS INCORRECT, THE CORRECT
SUPERFUND HOTLINE NUMBER IS
800-246-8198**

The Proposed Remedy - a Summary

The proposed remedy for the Streamside Tailings Operable Unit is Alternative 6 as described on page 15 of this document and in the Feasibility Study. This remedial action is proposed by MDHES as the most effective means to meet the SST OU remedial objectives and as representing the best balance of considerations under the criteria for selection of remedies under CERCLA and the NCP. To introduce and explain the proposed remedy, contaminant sources are listed by media (i.e. tailings/impacted soils, in-stream sediments, railroad materials, and ground water) and are described below. While surface water in Silver Bow Creek is a primary receptor of SST OU contamination, it was not specifically considered for separate remedial action. Remedial activities for other SST OU media and sources of contaminants upstream/offsite will limit further releases to surface water. More detail on each media specific alternative can be found in the Feasibility Study.

Briefly, the Preferred Alternative for Streamside Tailings OU proposes to:

1. Excavate and remove 78% (or 1.8 of 2.3 million cubic yards [cy]) of tailings/impacted soils from the floodplain. There would be approximately 540,000 cy of floodplain tailings/impacted soils left in Subarea 4 which would be treated by the STARS technology. At Ramsay Flats 240,000 cy of tailings located outside the current 100-year floodplain would be treated with STARS, consolidated and treated with STARS, or consolidated and capped with soil.

2. Remove all (approximately 73,000 cy) fine grained (less than 1mm or the size of coarse sand) in-stream sediment which would be mobilized in a bank-full flow event. The fine fraction represents the major repository for contaminants for in-stream sediments.

3. Remove, cover, or treat all railroad materials which affect human health or the environment (approximately 55,200 - 167,300 cy).

4. By removing the primary sources of ground water contamination through the above actions, ground water contamination will attenuate and dilute over time. No additional action addressing or directly treating ground water is proposed.

Tailings/impacted soils

Tailings/impacted soils are the primary contaminant source for the SST OU. They range in thickness from a few inches to greater than five feet and contain significantly elevated concentrations of arsenic, cadmium, copper, lead, mercury, and zinc (see Table 1). There are three predominant ways in which tailings/impacted soils contaminate other Silver Bow Creek media: direct contact between tailings and ground water, infiltration of precipitation through tailings, and erosion of tailings into Silver Bow Creek.

In many areas, ground water is in direct contact with tailings/impacted soils. This direct contact mobilizes metals from the tailings/impacted soils, contaminating the ground water. Seasonal water table fluctuation increases the volume of tailings/impacted soils exposed to ground water. This is a principal mechanism for ground water contamination at the site.

Infiltration of water through the tailings in the vadose zone (the unsaturated zone between ground surface and the water table) is another method by which tailings contaminate ground water and soils. This situation is particularly notable where ground water is close to the tailings/impacted soils and/or where the highly porous nature of sand size tailings facilitates rapid infiltration and transport of contaminants to ground water.

Erosion of tailings/impacted soils by overland flow, over bank flow, and mass wasting/slumping are primary methods of tailings/impacted soils transport to Silver Bow Creek. Over time, Silver Bow Creek will naturally meander in its floodplain, eroding material from cutbanks and depositing material in point-bars and depositional areas. Changes in creek elevation, as well as ice buildup during winter months, cause undercutting of banks and direct erosion of tailings/impacted soils into the creek. Precipitation or snowmelt runoff erodes tailings/impacted soils through surface erosion and carries contaminants to Silver Bow Creek. In addition, during dry periods, highly soluble metal salts wick to the surface of bare tailings as soil moisture evaporates. These metal laden salts are quickly dissolved and washed into the creek during summer thunderstorms.

High water and storm events cause a number of concerns with respect to tailings/impacted soils, including erosion of the streambanks, channel migration, and erosion by over bank flows. Inundation or saturation of tailings/impacted soils during these events increases the volume of water in contact with tailings/impacted soils during infiltration. Consequently ground water would be degraded.

To meet the SST OU remedial objectives established for the site (see sidebar on page 7), MDHES has determined that tailings/impacted soils should be removed from the floodplain where:

(1) tailings/impacted soils are saturated by ground water during any part of the year,
(2) STARS treatment (in-situ lime amendment and revegetation) cannot reliably immobilize the contaminants, for example, due to the depth of the tailings or proximity to ground water (lack of any buffer materials between the treated tailings and the ground water), or
(3) the treated tailings could be eroded by natural stream migration or flood events (see STARS discussion on page 19).

Table 2 describes the volumes by subarea (see Figure 1) which fall under one or more of these categories, and therefore must be removed. Application of in-situ remediation for the remaining tailings/impacted soils is considered appropriate.

Table 1

Median Concentrations of Tailings/Impacted Soils - Streamside Tailings OU (mg/kg)

	Reference	Subarea 1	Subarea 2	Subarea 3	Subarea 4
pH (su)	5.6	4.3	4.3	4.0	4.5
Arsenic	39	278	563	215	249
Cadmium	3.2	7.8	16.2	5.5	6.3
Copper	99	739	2,710	1,290	1,315
Lead	55	540	1,510	316	638
Mercury	0.13	2.1	11.0	1.2	2.7
Zinc	126	2,400	5,400	1,445	1,805

Note: "Reference" soils are considered to be outside the influence of flood deposited tailings but could be impacted by other contaminant sources.
mg/kg = milligrams per kilogram. su = standard units.

MDHES proposes to remove 1.8 million cubic yards (cy) of tailings/impacted soils based on the factors described above. Most of the excavated tailings and soils would be from areas near Silver Bow Creek or areas with shallow ground water. The specific depth of excavation and amount of excavated materials will be determined during remedial design. Excavation design will be based on the "order of magnitude" methodology used to delineate the vertical extent of tailings/impacted soils in the RI. Precise numeric cleanup criteria for excavation are not proposed. MDHES anticipates that excavation will be by conventional methods utilizing dewatering and dry excavation, to the extent possible. In some areas it may be possible to form a new channel where saturated tailings are excavated on one side of the stream. When the stream is rerouted into that new channel, the original channel will be dewatered to allow easier excavation of the remainder of the tailings and sediments (see below). In some instances a new channel may be designed and utilized as a permanent replacement channel.

The ultimate method of excavation will be determined by the party implementing the action. Removed material would go to one or both of two possible regional repositories: Opportunity Ponds and/or to a location along Browns Gulch. Either truck or rail haul may be used.

Approximately 780,000 cy of tailings/impacted soils will be treated with the STARS technology. This would include approximately 240,000 cy of tailings outside the floodplain at the Ramsey Flats and 540,000 cy of tailings in Subarea 4, in the Upper Deer Lodge Valley between Durant Canyon and the Warm Springs Ponds. Lime amendments will be incorporated into the tailings and the surface revegetated with drought and acid tolerant grass species. For those areas outside of the 100-year floodplain where residential development is possible, cover soil and restrictions on excavation to prevent direct contact risk to residents may be required. Monitoring and maintenance of the treated areas will be required.

Sediments

In-stream sediments can be attributed directly to the erosion of streamside tailings/impacted soils, and the continued reworking by the creek of channel and floodplain deposits which consist largely of tailings/impacted soils. These in-stream sediments are highly contaminated above natural conditions, between 10 and 65 times higher for arsenic, cadmium, lead, zinc, and 400 times higher for copper. Traditional concepts of the relationship between metal content and grain size of in-stream sediments assumes that the fine-grained fraction contains the majority of the metals. This concept has been supported by Silver Bow Creek sediment sampling data. Fine-grained in-stream sediments represent the predominant repository for contaminants in sediments and, like tailings themselves, vary in size from a coarse sand to a very fine silt or clay (<1mm).

In the stream, these sediments severely limit the number and types of aquatic insects (benthic macroinvertebrates) which live in the stream sediments, and these sediments could act as a source of contamination to future cleaner surface water. One of the primary objectives for the SST OU is to support a self-reproducing fishery for trout species. Trout require a healthy and diverse population of benthic macroinvertebrates in sufficient numbers to serve as a food source.

As determined in the Baseline Risk Assessment, contaminants in sediment posing a high risk to the ecological communities are arsenic, cadmium, copper, lead, mercury, and zinc. Mercury is a contaminant which concentrates in plant and animal tissue (bioaccumulation) and can potentially move up in the food chain (biomagnification). Mercury poses a small current threat because there are no fish in the creek, but would be a threat to a re-established fishery if left in place.

Table 2

Summary of Media Specific Removal Volumes for Alternative 6 (cy)

Subarea	Tailings/impacted soil	Sediments	Railroad Materials
1	285,000	15,000	18,600 - 101,600
2	568,000	22,700	18,200 - 28,900
3	160,400	5,600	18,400 - 36,800
4	756,240	29,700	0
Total	1,769,640	73,000	55,200 167,300

Note: The site contains approximately 2,550,000 cy of tailings/impacted soils of which approximately 2,300,000 cy are in the current 100-year floodplain. All volumes are in cubic yards (cy).

To meet the remedial objectives for the SST OU, MDHES has determined that all fine-grained (<1mm) sediments should be removed and placed in a repository with the tailings/impacted soils. The extraction of all fine-grained sediment would remove the bulk of sediment contamination. Sediment size delineation, as opposed to a removal standard based on a numerical concentration, will be used for the remedial criteria. The sediment volumes reported in Table 2 represent an estimate of all fine grained in-stream sediment which would be transported by Silver Bow Creek at "bank-full" flow conditions. Bank-full flow describes the elevation of the water in the creek which is reached every year or two.

Removal of 73,000 cy of in-stream sediments will be conducted with conventional methods utilizing dewatering excavation techniques. These efforts will be coordinated with tailings/impacted soil removal, with all contaminated material being placed in one or two regional repositories. After removal the channel would be reconstructed with materials of appropriate size, shape, and composition along with suitable bedforms (riffles, bars, pools etc.). During remedial action some sections of channel will need to be dewatered. This dewatering will be coordinated with tailings/impacted soils removal and could, in some areas, utilize a permanent replacement channel.

Railroad materials

Certain portions of one abandoned historic (the Milwaukee) railroad embankment and two operating railroads along Silver Bow Creek were constructed with mine and mill wastes such as waste rock and slag. Additionally some spillage from ore and ore concentrate haulage along the Butte, Anaconda and Pacific line has been identified. These railroad materials represent a source of contaminants to Silver Bow Creek via runoff, to ground water via infiltration, and to recreationists who might use the abandoned Milwaukee embankment as a trail for walking or biking. Silver Bow Creek surface water is most significantly impacted by railroad materials at bridge abutments and where railroad bed material forms a bank of the creek.

The proposed remedy would excavate or cover impacted railroad materials that present a risk to recreational users. A limited amount of ore concentrate spillage would be excavated and disposed along with excavated tailings/impacted soils at a regional repository. Other areas of the Milwaukee railroad embankment, to be defined specifically during remedial design, would be STARS treated. The top of the grade may ultimately be covered with soil, gravel or asphalt as part of a Silver Bow Creek trail system. Railroad bed materials directly impacting the creek, either at bridge abutments or along the streambank, will be excavated and disposed of along with tailings/ impacted soils. MDHES anticipates that generally it will not be necessary to excavate entire bed sections; where possible, the streamside toe and sideslope of the railroad embankment will be removed to a depth of a few feet and replaced with clean material. The actual amount of excavation will be determined during remedial design. Armoring of the new embankment will be necessary to prevent erosion. No removal or realignment of the railroads is proposed.

Ground water

Generally, ground water within the SST OU flows towards and into Silver Bow Creek. Elevated concentrations and exceedances of drinking water standards (Maximum Contaminant Levels [MCLs] and Maximum Contaminant Levels Goals [MCLGs]) for metals and arsenic were found in most of the shallow (<20 feet below ground surface) monitoring wells. Stream quality is impacted by inflowing ground water. Removing all sources of ground water contamination by addressing tailings/impacted soils and railroad materials, will allow contaminants in ground water to attenuate over time through adsorption, precipitation, dilution, and dispersion. Removal of these sources will also help in meeting surface water and sediment objectives. No additional action addressing or directly treating ground water is proposed.

The following documents provide the primary basis for the MDHES recommendation to adopt Alternative 6 as the preferred remedy.

1. MultiTech, 1987, Silver Bow Creek Phase I Remedial Investigation,Final Report, prepared for MDHES.

2. CH2M Hill, 1989, Silver Bow Creek Flood Modeling Study, prepared for MDHES.

3. ARCO, 1993, Streamside Tailings Operable Unit RI/FS, Preliminary Remedial Action Objectives Report/Treatment Technology Scoping Document.

4. MDHES, 1994, Screening and Description of Potential Applicable or Relevant and Appropriate Requirements for the FS Analyses of Alternatives.

5. MDHES, 1994, Draft Baseline Risk Assessment, Streamside Tailings Operable Unit.

6. ARCO, 1995, Draft Remedial Investigation Report, Streamside Tailings Operable Unit.

7. ARCO, 1995, Draft Feasibility Study Report, Streamside Tailings Operable Unit.

Implementation and coordination

Construction of the proposed remedy will be coordinated with other cleanup activities along Silver Bow Creek, particularly the Lower Area One (see Figure 1) expedited response action and the Butte stormwater portion of the Priority Soils OU. Releases of contaminated sediments and surface waters prior to and during implementation of those actions, which might re-contaminate a remediated Silver Bow Creek, must be adequately controlled and treated.

The design and schedule of the Streamside Tailings remedy will be coordinated with the design and installation of upstream sediment control basins and water treatment facilities. If adequate upstream facilities are not in service at the time of initiation of construction of the proposed remedy, then additional sediment control and treatment facilities may have to be provided as part of this remedy to protect the Streamside Tailings cleanup from recontamination.

Construction of the remedy within and near Silver Bow Creek will create temporary releases of contaminated sediments and degraded surface water. The Warm Springs Ponds treatment facility should be able to treat the increased loading, although, depending on flow conditions and the level of degradation, some reduction in the quality of the Warm Springs Ponds discharge may be seen.

As the metals loadings in Silver Bow Creek surface waters decrease over time, the adverse effects of nutrient and organic loadings from the Butte sewage treatment plant will become more pronounced in the upper reaches of Silver Bow Creek. Upgrades of the sewage treatment plant may be necessary to maintain the overall improvement of these upper reaches.

Operable Unit Background

The Streamside Tailings OU extends from just below the Colorado Tailings in Butte 24 miles downstream to the inlet of the southern-most of the three Warm Springs Ponds (see Figure 1). The SST OU includes not only Silver Bow Creek, but also the mining wastes along the creek banks, adjacent floodplain, and railroad beds. Wastes and contamination associated with the Rocker OU will be addressed under a separate plan.

Wastes from mining, milling and smelting facilities and other sources once located in Butte and along Silver Bow Creek have washed down the creek for more than 100 years. These wastes, known as tailings, are contaminated with arsenic and metals such as lead, copper, zinc, cadmium and mercury (see Table 1). An estimated 2,500,000 - 2,800,000 cubic yards of tailings and contaminated or impacted soils are widely scattered (≈ 1,300 acres) along Silver Bow Creek. In some areas, the tailings are several feet thick. The largest tailings area, 160 acres, lies near the town of Ramsay and is known as Ramsay Flats.

Railroads adjacent to Silver Bow Creek were partly constructed using waste rock and/or slag containing metals and arsenic. In addition, ore concentrate, hauled by rail between Butte and Anaconda, has spilled along the tracks during transport. Available data demonstrate contamination at various locations along the railroads. The extent of this contamination has not been fully quantified. Because the railroad lines lie close to Silver Bow Creek and the associated contamination of the bed and ballast material can impact ground water and surface water in Silver Bow Creek, these lines were included in the site investigation.

Environmental investigations in the vicinity of the SST OU were initiated by EPA in 1982. The Silver Bow Creek Site was listed on the National Priority List (NPL) in 1983 by EPA under the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) and was later amended to include the Butte Area in 1987. Site investigations under CERCLA began in 1984 with the Phase I Remedial Investigation (RI) prepared by MultiTech under contract to MDHES. The Phase II RI described in the Draft RI Report was conducted by ARCO and describes investigation activities, characterizations and interpretations performed since 1991. All pre-1991 studies or data that ARCO and MDHES determined to be applicable or pertinent to current site conditions were incorporated in the 1995 Draft RI Report. The Draft RI Report complied with Superfund law, defined the nature and extent of contamination as necessary, and provided information to complete the baseline human health and ecological risk assessments.

Cleanup Objectives for Streamside Tailings

1. Improve Silver Bow Creek surface water quality such that the concentrations of inorganic contaminants meet water quality applicable or relevant and appropriate requirements (ARARs) or other risk-based levels.

2. Improve Silver Bow Creek over time to a condition that supports a self- reproducing fishery for trout species.

3. Prevent exposure to inorganic contaminants in tailings/soils in excess of risk-based or other relevant levels, for both human health and environmental receptors.

4. Prevent migration of inorganic contaminants in tailings/soils that would impact surface water and in-stream sediments to a degree that would cause noncompliance with surface water ARARs or other risk based levels.

5. Protect all solid waste within Streamside Tailings Operable Unit from flood displacement in accordance with ARARs.

6. Prevent degradation of the present quality of ground water underlying the site.

7. Attain compliance with ground water quality applicable or relevant and appropriate requirements (ARARs) or other risk-based levels for inorganic contaminants for all impacted ground water underlying the site.

For a more detailed list see "Preliminary Remedial Action Objectives Report and Treatment Technology Scoping Document", July 1993.

Nature and Extent of Contamination

Five media were sampled during the RI: surface water, soils, ground water, in-stream sediments, and railroad materials. The RI concluded that contamination was found in all media throughout the OU.

The investigation revealed five primary sources of contamination:

(1) upstream (outside of the OU);
(2) tailings/impacted soils;
(3) ground water;
(4) in-stream sediments;
(5) railroad materials.

Upstream sources include, among others, mine wastes, storm water discharges, and mine/mill tailings.

The alluvial aquifer has been arbitrarily divided into two units, the upper and lower, which are hydraulically interconnected. Twenty-three wells in the upper alluvial aquifer (<20 feet below ground surface) along with 19 wells in the lower alluvial aquifer (>20 feet below ground surface) were monitored in the SST OU. Elevated metals concentrations and exceedances of drinking water standards MCLs and MCLGs were found in most of the upper alluvial monitoring wells. These exceedances were primarily limited to arsenic and cadmium. There were no exceedances of MCLs in the lower alluvial aquifer.

Ground water annually fluctuates an estimated two feet and, in many areas is in direct contact with tailings/impacted soils for at least part of the year. This direct contact mobilizes metals from the tailings and contaminates the ground water. This is a principal mechanism for ground water contamination along the creek. Infiltration of water through the vadose zone in tailings deposits and into the saturated zone is another method by which contaminants move into ground water. Generally, ground water flows toward and into the creek. Contaminated ground water is also a likely source of additional contaminant loading to surface water and in-stream sediments. Metals are added to the in-stream sediments when acidic ground water transports contaminants to the relatively higher pH water of Silver Bow Creek where the contaminants precipitate out of the water and adsorb onto in-stream sediments.

The major source of contaminated sediment is the sand to clay size (<1mm) tailings/impacted soils which border the creek for its entire 24 mile length. As the creek erodes into the tailings/impacted soils, these materials are entrained into the in-stream sediment system. Contaminated in-stream sediments also enter the creek as bedload from upstream, from reworking of previously deposited in-stream sediments, from surface water runoff or overland flow, and from the precipitation of dissolved metals in ground water discharge to surface water. Significantly higher metal concentrations occur in the finer (sand to clay size) sediments than coarser sediments. In general, fine-grained sediments in Silver Bow Creek have much higher concentrations of contaminants than reference or background conditions; between 10 and 65 times higher for arsenic, cadmium, lead, and zinc, and 400 times higher for copper. These finer sediments would be transported during a bank-full flow event some short distance.

These highly elevated levels of metals and arsenic are a biologically available source of contamination and directly impact aquatic life. These metals also could retard future water quality improvements. Most insects are not able to survive in the sediment concentrations currently found in Silver Bow Creek. Silver Bow Creek surface water and in-stream sediments are the primary recipients of contaminants from on and off-site sources (see Table 3).

Table 3

Silver Bow Creek Surface Water Quality, Geometric Mean Low Flow Concentrations (µg/l)

	WQB-7		SS-07	SS-10	SS-14	SS-16	SS-17
	Chronic	Acute	Inflow	Silver Bow	Miles Crossing	Fairmont	Opportunity
pH (su)	NA	NA	7.3	8.0	7.9	8.2	9.6
Arsenic	190	360	8.7	14.5	11.7	15.4	18
Cadmium	1.1	3.9	1.6	2.5	1.1	1.1	0.7
Copper	12	18	178	322	163	140	140
Lead	3.2	82	5.3	15.2	5.4	4.6	1.9
Zinc	110	120	682	860	532	455	366

Note: All values given in "total" concentrations, (µg/l).
See Glossary for definition of WQB-7.
WQB-7 values correspond to a total hardness of 100 mg/l CaCO3.

What Risks Does the Operable Unit Pose?

As part of the remedial investigation and feasibility study, MDHES developed a Baseline Risk Assessment for human health and ecological risks to provide:

(1) an analysis of present and future risk if no remedy occurs and to help determine the need for action,
(2) a consistent process to evaluate and document present and future public health and ecological threats at the site, and
(3) a basis to compare potential health and ecological impacts of various cleanup alternatives.

A risk assessment uses a combination of facts and assumptions to estimate the potential for adverse effects on human health from exposure to contaminants found at a site. EPA has set a risk range from 1 in 10,000 (1×10^{-4}) to 1 in 1,000,000 (1×10^{-6}) excess lifetime cancer risk as the goal for Superfund sites, with a preference for the 1×10^{-6} level. A risk of one-in-one-million means that one person out of one million would be expected to develop cancer as a result of a lifetime of exposure to site contaminants.

In the human health risk assessment, MDHES estimated risks for on-site residents, workers and recreationists exposed to contaminated tailings/ impacted soils, surface water, ground water, and sediments assuming no remedial action is taken at the site. The human health risk assessment identified potential cancer risks greater than 1 in 10,000, indicating that, without remediation, future on-site residents' and recreationists' potential cancer risks would remain unacceptable for exposure to ground water, soils, and railroad materials. People may be directly exposed to contaminants on the one abandoned railroad bed as they walk or ride a bike along the railroad right-of-way. There are also other health risks at the site unrelated to cancer.

The ecological risk assessment for the site evaluated the potential or actual harm to terrestrial and aquatic populations from exposure to contaminants. In Silver Bow Creek, which is devoid of fish and many other aquatic life forms, the presence of mine waste contamination is the primary factor limiting the health of the aquatic environment. These contaminants affect both the water quality and in-stream sediments in Silver Bow Creek and create a toxic environment for fish and most aquatic insects (benthic macroinvertebrates).

Contaminated sediments in Silver Bow Creek act as a critical pathway to impacted surface water and aquatic biota, particularly benthic macroinvertebrates. Other non-contaminant concerns which likely affect the health of Silver Bow Creek include siltation of the stream bottom, channelization, disturbance of adjacent land and streamside (riparian) habitat, and the Butte waste water treatment plant discharge.

MDHES has concluded through the Baseline Risk Assessment that hazardous substances at the OU cause excessive human health cancer risks and extensive ecological risks limiting the health of the aquatic and terrestrial environment. Actual and threatened releases of hazardous substances from this site, if not addressed by cleanup, may present an imminent and substantial endangerment to human health and the environment. Therefore, remedial action is required to reduce these risks.

CALL US

If you have comments, concerns
or questions about
the Streamside Tailings,
call the toll-free
Superfund hotline in Helena,
8 a.m. to 5 p.m. weekdays.

1-800-648-8465

The Alternatives

The development and evaluation of remediation alternatives under consideration for the SST OU is more fully documented in the FS. Initial screening of alternatives was reported in the Preliminary Remedial Action Objectives Report/Treatment Technology Scoping Document (ARCO, 1993). Subsequent development and refinement of the alternatives was documented in the FS. A full range of alternatives from no action through total removal of all contaminants was carried through the detailed analysis of the FS.

Alternatives were considered for each of the four contaminated media and were evaluated, utilizing the NCP's remedy selection criteria, on a subarea basis in the FS. Those alternatives which were significantly deficient in meeting remedial action objectives in certain subareas for specified media were dropped from further consideration after the detailed analysis. Alternatives carried forward were then subjected to comparative analysis in the FS, again on a media-specific and subarea basis. Finally, representative groupings of the media-specific and subarea alternatives were assembled into comprehensive site-wide alternative packages to enable MDHES to evaluate the interaction of alternatives for the different media and to conduct a reasonable comparison of the costs of various alternatives.

The alternatives described in this proposed plan are the comprehensive site-wide alternatives. This comparison gives the best overall picture of the range of alternatives possible at the site. However, the final selected remedy could include portions from each of the alternatives. The selected remedy will be comprised of those elements from all the alternatives that, when combined, best satisfy the remedy selection criteria.

Seven primary media-specific alternatives for tailings/impacted soils were considered in the FS. Of those, Surface Water Controls (TS2) and Near-stream STARS (TS3) were determined to be wholly inadequate in meeting site objectives and were eliminated as possible choices for the development of combined alternatives. No Action (TS1) and the remaining action alternatives (TS4-TS7) have been included in the combined alternatives considered here.

The tailings/impacted soils elements of the seven combined media alternatives include five possible components: STARS, partial relocation, partial removal, total relocation or total removal. STARS is the application of lime amendments to the tailings/impacted soils and revegetation to treat and stabilize the tailings in place. Relocation and removal differ only in the location of the repository for excavated materials (numerous nearby repositories vs. one or two regional repositories, respectively). The difference between partial relocation/removal and total relocation/removal is how much tailings/impacted soils are excavated. Total relocation/removal for a subarea would require excavation of all tailings/impacted soils in the subarea. Total relocation/removal of materials for the entire OU would excavate all 2.5 million cy of tailings/impacted soils. Partial relocation/removal alternatives would excavate only portions of the tailings/impacted soils, as described in each alternative.

A pivotal issue in the selection of a remedy for the SST OU is the extent to which floodplain tailings must be removed from the floodplain in order to attain protectiveness. In addressing this issue MDHES has evaluated, on a technical basis, where STARS can be applied to attain protectiveness standards.

In general, MDHES has determined that STARS is not sufficiently protective in locations where:

(1) tailings/impacted soils are saturated by ground water during any part of the year,

(2) STARS treatment cannot reliably immobilize the contaminants, for example, due to the depth of the tailings or proximity to ground water (lack of any buffer materials between the treated tailings and the ground water), or

(3) the treated tailings could be eroded by natural stream migration or flood events (see STARS discussion on page 19).

The analysis of alternatives reflects this determination by MDHES, even though alternatives for lesser amounts of excavation from the floodplain are retained in various alternatives for purposes of evaluation.

Four alternatives for addressing contaminated railroad materials were considered in detail in the FS. Three of the railroad material alternatives are represented in the comprehensive alternatives in the proposed plan. The four railroad media alternatives included No Action (RRM1), Limited Removal (RRM2), Soil Cover (RRM3), and In Situ Amendment (RRM4). Alternative RRM4 would consist of applying an in situ STARS treatment to the impacted railroad grade. As part of STARS treatment, limited soil cover, as described for RRM3, may be considered. Because of this overlap RRM3 was not separately included in any site-wide alternative.

Three ground water remediation alternatives were considered in the FS, including No Action (GW1), Source Control (GW2), and Pump and Treat (GW3). Pump and Treat was eliminated from further consideration after the detailed analysis because the cost of active treatment was not commensurate with benefits gained in cleaning the potentially widespread, but relatively low level of ground water contamination found at the site. No Action was similarly considered inappropriate except for comparison purposes, so all comprehensive alternatives include Source Control as the ground water treatment component.

Three alternatives for remediating in-stream sediments were considered: No Action (SD1), Limited Removal (SD2), and Total Removal (SD3). For either removal option, both on-site and regional repository locations were evaluated. All sediment remediation options are represented in the comprehensive alternatives.

A brief description of site cleanup alternatives considered in the Feasibility Study report follows. The estimated present worth cost of each alternative includes capital cost and annual operation and maintenance cost. Remedial action time frames are limited to 30 years for analysis, even for those alternatives requiring perpetual operation and maintenance, since costs beyond 30 years have minimal present worth.

Alternative 1

No Action for Tailings/Impacted Soils (TS1), In-stream Sediments (SD1), Railroad Materials (RRM1), and Ground Water (GW1).

Estimated present worth cost:	**$700,000 to $1,400,000**
Implementation time:	**Not**

Superfund law requires that agencies consider the no action alternative. This alternative is used as a baseline against which to compare the other alternatives. Under Alternative 1, no further action would be taken. Contaminated tailings/impacted soils, sediments, railroad materials, and ground water would remain on site and would continue to migrate and impact ground water, Silver Bow Creek, and bed sediments, posing a continued risk to human health and the environment. The costs for the no-action alternative are associated with continued administration of monitoring for a period of 30 years. Actual costs and efforts associated with the no action alternative would be incurred indefinitely beyond the 30-year period.

Alternative 1 would not meet protectiveness standards and would not attain ARARs (see Glossary, page 23). It would achieve no long-term effectiveness or reduction in contaminant toxicity, mobility and volume.

Alternative 2

STARS Treatment of Tailings/Impacted Soils (TS4), No Action for In-stream Sediments (SD1), In Situ Treatment of Railroad Materials (RRM4), and No Action for Ground Water (GW1).

Estimated present worth cost: **$13,000,000 to $24,000,000**
Implementation time: **3 - 5 years**

The primary component of this alternative is STARS, which was developed as a potential low-cost alternative to removal and controlled disposal of the tailings/impacted soils that comprise the primary source of contamination at the site. STARS consists primarily of tilling certain lime amendments into the tailings/impacted soils to neutralize the pH and immobilize certain metals. Under this alternative tailings/impacted soils would be treated in situ with the STARS technology.

This treatment would include revegetation, thereby reducing overland flow and wind erosion. In-stream sediments and ground water would receive no action. There would be limited removal of impacted railroad materials posing a risk to health and the environment. In contaminated areas of potential residential development (i.e., outside the 100-year floodplain), this alternative would use a soil cover where the contaminants pose significant human health risk. Significant long-term maintenance and monitoring would be required. Restrictions on site access and use would be necessary.

This alternative has severe limitations in its ability to meet SST OU protectiveness standards and ARARs. Although STARS has demonstrated short-term success in establishing vegetative cover, its ability to withstand stresses from recreational and agricultural (grazing) use, and therefore to provide protectiveness to Silver Bow Creek in the long term, is less certain. STARS provides no mechanism for control of contaminant mobility in saturated tailings and cannot be considered a ground water source control remedy where ground water and tailings are in contact seasonally.

The STARS portion of this alternative would only amend the tailings/impacted soils to a depth of two feet below ground surface, would not allow adequate separation of amended zones and ground water in many areas, would not address the impacts associated with saturated tailings/impacted soils, and would be subject to erosion from normal stream processes or major flood events. Near-stream areas with shallow ground water or with active stream meander would remain susceptible to continued loading of contaminants from tailings/impacted soils into Silver Bow Creek surface water and bed sediments for many decades.

For the reasons identified above, there is considerable uncertainty whether STARS can maintain its effectiveness over the long-term within many parts of the Operable Unit. Mobility of certain metals in the amended zone would be reduced, assuming that erosional processes did not move them over time. However, certain contaminants, particularly arsenic, may exhibit increased mobility when treated by STARS. Cost, implementability, and short-term effectiveness are favorably rated under this alternative.

Leaving all in-stream sediments in place would prevent attainment of the goal of establishing a self-reproducing trout fishery for decades, until natural processes could flush all contaminated sediments from the OU and into the Warm Springs Ponds. If failure of the STARS component allowed continued input of contamination to in-stream sediments in the future, natural flushing may never occur.

Alternative 3

Partial Relocation and Partial STARS Treatment of Tailings/Impacted Soils (TS5), Limited Removal of In-stream Sediments (SD2), In Situ Treatment of Railroad Materials (RRM4), and Source Controls for Ground Water (GW2).

Estimated present worth cost: **$21,000,000 to $40,000,000**
Implementation time: **3 - 5 years**

This alternative was developed to address one of the three limitations of STARS, saturated tailings. Under this alternative, a total of approximately 700,000 cy of tailings/impacted soils which are seasonally saturated by ground water and tailings overlying these tailings would be relocated outside the 100-year floodplain but near the site of removal. These repositories would be treated with the STARS treatment technology. All remaining tailings/impacted soils would be STARS treated in place. All STARS related concerns described under Alternative 2 would remain except the saturated tailings issues. Removal of only saturated tailings would leave unacceptable residual risk to human health and the environment.

In-stream sediments would be removed and relocated out of the 100-year floodplain and into an adjacent repository. The volume of in-stream sediments defined for limited removal represents all fine-grained sediment which would be transported in a bank-full flow event. This size fraction incorporates the majority of contaminated in-stream sediments. Only limited data exist to estimate the volumes of in-stream sediments by size fraction. Based on quantities of sediments estimated during the SST RI, MDHES estimates this volume at about 73,000 cy. Additional refinement of that estimate is anticipated prior to the Record of Decision or during remedial design.

Railroad materials would receive in-situ STARS treatment. As part of the treatment, limited soil cover is being considered.

This alternative would not meet overall protectiveness standards and would not comply with ARARs because tailings/impacted soils could be eroded by natural stream migration and/or flood events. By relocating some tailings out of the floodplain, overall long-term effectiveness is somewhat enhanced over Alternative 2. The use of presently uncontaminated areas for local repositories would be necessary, although in some cases existing disturbed areas may be available. However, considerable maintenance of numerous local repository locations and STARS treated areas would reduce long-term effectiveness in comparison to a single repository. Short-term impacts during construction of the remedy would be managed by reducing haul distance and minimizing use of public roads because repository locations are adjacent to excavation areas. Removal of saturated tailings and in-stream sediments would present excavation difficulties, but is clearly implementable. There would be a significant level of long-term maintenance and monitoring. Site access and use would have to be restricted in many locations.

Alternative 4

Partial Removal and Partial STARS Treatment of Tailings/ Impacted Soils (TS5), Limited Removal of In-stream Sediments (SD2), Limited Removal of Railroad Materials (RRM2), and Source Controls for Ground Water (GW2).

Estimated present worth cost:	**$27,000,000 to $47,000,000**
Implementation time:	**3 - 5 years**

Alternative 4 is the same as Alternative 3 except for the following: saturated tailings/impacted soils (700,000 cy), in-stream sediments and railroad materials would be removed and transported to a regional repository at Opportunity Ponds or a location along Browns Gulch. Removal of only saturated tailings would leave major on-site potential residual risk to human health or the environment. If the Opportunity Ponds were used as the repository location, the total volume of additional tailings from the SST OU added to the Ponds would be inconsequential. All STARS related concerns described under Alternative 2 would remain, except saturated tailings issues. There would be a significant level of long-term maintenance and monitoring. Site access and use would be limited in many locations.

This alternative is also generally equivalent to Alternative 3 in terms of not meeting protectiveness standards and compliance with ARARs. Short-term effectiveness may be reduced because of inherent construction impacts on nearby residents and communities from considerable truck traffic needed to haul excavated materials to a regional repository. This reduced short-term effectiveness could be offset if rail transport were used. Long-term effectiveness, reduction in toxicity, mobility and volume, and implementability are similar to Alternative 3, although a single, controlled repository would offer clear advantages over numerous, scattered repositories. If a new Browns Gulch repository is established, presently uncontaminated land would have to be used for that purpose.

Alternative 5

Total Relocation of Tailings/Impacted Soils in Subareas 1 and 3 (TS7), Partial Relocation and Partial STARS Treatment in Subareas 2 and 4 (TS6), Limited Removal of In-stream Sediment (SD2), Limited Removal of Railroad Materials (RRM2), and Source Controls for Ground Water (GW2).

Estimated present worth cost:	**$32,000,000 to $55,000,000**
Implementation time:	**4 - 6 years**

This alternative has been developed to address the limitations of STARS in effectively meeting the SST OU's threshold protectiveness standards and ARARs (see STARS discussion on page 19). Under this alternative, an estimated total of 1.8 million cubic yards of tailings/impacted soils would be relocated to local dry closures located adjacent to the site, but outside of the 100-year floodplain. Total excavation of all tailings/impacted soils within the 100-year floodplain would be required in Subareas 1 and 3 because potential STARS treatment areas could not be adequately protected from erosion.

This alternative modifies partial relocation to include excavation and relocation of all tailings/impacted soils within the floodplain in Subarea 2 and excavation and relocation of additional near-stream tailings in Subarea 4. In Subarea 2, about 240,000 cy of tailings/impacted soils in the Ramsay Flats area located outside of the 100-year floodplain would be treated with STARS, with a portion covered with cover soil. In Subarea 4, approximately 760,000 cy (out of the 1,300,000 cy identified in the subarea) would be removed and the remainder treated with STARS. Excavated tailings/impacted soils would be treated with lime amendments prior to placement in the relocation areas.

As in Alternative 3, in-stream sediments would be excavated and placed in the relocation areas adjacent to the site. The volume of in-stream sediments defined for limited removal includes all fine-grained sediments, which represent those posing the most significant risk to health and the environment. As in Alternative 4, selected contaminated railroad materials would be excavated and placed into local relocation repositories.

This alternative would meet overall protectiveness standards and would comply with ARARs, except for the floodplain and solid waste management ARARs in certain locations in Subarea 4. In those particular locations, an ARAR waiver, based on a demonstration that STARS, when applied under certain conditions where it could meet an equivalent standard of performance, may be possible. This alternative also would meet the preliminary remedial action objectives for tailings/impacted soils and surface water. Objectives for ground water would be met over time through source control, followed by natural attenuation of residual contaminants.

By relocating all floodplain tailings out of the floodplain, except where equivalent performance could be demonstrated in Subarea 4, overall long-term effectiveness is considerably enhanced over Alternatives 3 and 4. Erosion would be reduced by stabilizing the reconfigured floodplain with vegetation and enhancing channel stability. Mobility of tailings/contaminated soils is significantly reduced by placing materials in controlled relocation areas.

Long-term monitoring and maintenance costs for stream control measures would be reduced in comparison with other alternatives, but the considerable amount of materials placed in local relocation areas would require substantial maintenance. Site access and use restrictions would be necessary for the STARS-treated areas and relocation sites.

The effectiveness of removal of sediments and railroad materials would be similar to that seen under Alternatives 4 and 5.

The short-term effectiveness of this alternative would be lower than that of the previous alternatives because of the considerable additional amount of excavation work to be done, which would produce increased truck traffic to transport tailings/impacted soils, sediments, and railroad materials to the relocation sites. However, the time required to meet preliminary remedial action objectives for the site would be considerably shorter than the previous alternatives.

This alternative provides a balance in the quantity of tailings excavated and those treated in-situ with STARS by recognizing that tailings located outside the floodplain in Subarea 2 can adequately be protected in place and that some tailings in Subarea 4, due to their location relative to ground water and the stream, can adequately be treated in place without sacrificing long-term protectiveness.

Alternative 6 Preferred Alternative

Total Removal of Tailings/Impacted Soils in Subareas 1 and 3 (TS7), Partial Removal and Partial STARS Treatment in Subareas 2 and 4 (TS6), Limited Removal of In-stream Sediments (SD2), Limited Removal of Railroad Materials (RRM2), and Source Controls for Ground Water (GW2).

Estimated present worth cost:	**$39,000,000 to $66,000,000**
Implementation time:	**4 - 6 years**

Alternative 6 is similar to Alternative 5 in volumes and locations of contaminated media to be removed. The essential difference is that under this alternative the contaminated media would be removed to one or two regional dry repositories as opposed to 15 to 30 relocation repositories.

By relocating all tailings out of the floodplain, except in certain portions of Subarea 4, overall long-term effectiveness is enhanced. Erosion is reduced by stabilizing the reconfigured floodplain with vegetation and maintaining channel stability. Mobility of tailings/contaminated soils is significantly reduced by placing materials in controlled repositories. Site access and use is limited in only a few discrete locations.

This alternative meets all protectiveness criteria and complies with all ARARs except location specific solid waste and floodplain ARARs, which may be waived where technically supportable. The long-term effectiveness of this alternative is increased over Alternative 5 because the majority of contaminated materials would be consolidated into one or two regional repositories where wastes can be more easily managed in the long-term.

Anticipated benefits include:

(1) the wastes would be removed from the stream corridor, where repositories might be incompatible with future recreational or other land use development;
(2) significantly less restriction on residential, agricultural (grazing), or recreational land use near the floodplain would be necessary,
(3) the amount of presently undisturbed land used for waste repositories would be significantly reduced or eliminated,
(4) significantly reduced long-term monitoring and maintenance requirements, and
(5) reduced lime requirements for remedy.

Reduction in mobility of contaminants and implementability would be similar to that obtained with the other tailings and sediment removal and relocation alternatives. Greater short-term risks are associated with Alternative 6 in comparison with Alternative 5 because the waste materials would have to be transported greater distances. However, if rail transport to Opportunity Ponds is a viable and cost-effective form of transport for materials in the upper portion of the OU, the short-term risk is reduced considerably and may be less than for Alternative 5.

Alternative 7

Total Removal of Tailings/Impacted Soils (TS7), Total Removal of In-stream Sediments (SD3), Limited Removal of Railroad Materials (RRM2), and Source Controls for Ground Water (GW2).

Estimated present worth cost:	**$48,000,000 to $79,000,000**
Implementation time:	**4 - 7 years**

This alternative requires the most rigorous action of the alternatives considered and essentially removes all significant volumes of contaminated solid media from the site. This alternative differs from Alternatives 5 and 6 in that it includes removal of all waste sources in and out of the 100-year floodplain to a regional dry repository. A total of 2.5 million cy of tailings/impacted soils would be removed from the site. In-stream sediment volumes for total removal would be about 236,000 cy. Railroad materials and ground water components would be the same as for Alternatives 5 and 6. There would be a minor level of long-term maintenance and monitoring. Site access and use would not be limited.

This would be the most comprehensive cleanup alternative. It would meet all protectiveness standards and comply with all ARARs. It would provide good long-term effectiveness, reduction in contaminant mobility, and implementability. Short-term risks during construction are considerable due to the amount of material excavated and transported. Assuming railroad haul of excavated materials to the Opportunity Ponds, short-term impacts could be reduced.

Evaluating the Preferred Alternative

Superfund law requires that the agencies evaluate and compare the remedial cleanup alternatives based on the nine NCP criteria on page 18. The first two NCP criteria, protectiveness and ARARs, are threshold criteria and must be met unless an ARARs waiver is granted. This proposed plan discusses the evaluation and comparison based on the first eight criteria. After the public comment period is complete, the agencies will evaluate the alternatives based on the remaining criterion, community acceptance, and present that evaluation in the record of decision. The proposed remedy must meet the threshold criteria and provide the best balance of the selection criteria.

In assessing cleanup options, MDHES and EPA evaluated a wide range of media-specific alternatives for each of the four subareas of the SST OU. After detailed analysis and comparative evaluation of the media-specific alternatives, a group of seven comprehensive alternatives addressing all media in the entire site was developed and evaluated. The seven alternatives were described and key elements of the evaluation were presented in the preceding section.

Following is a brief summary of the agencies' evaluation of the proposed alternative. Additional detail regarding the full development and evaluation of the SST remediation alternatives is presented in the Feasibility Study.

Alternative 6 is the preferred alternative. It is protective of human health and the environment because it would reduce contamination of the Silver Bow Creek environment in which people live, work, and recreate, and should support a healthy ecosystem and protect aquatic resources.

The preferred alternative would comply with all applicable or relevant and appropriate requirements (ARARs) except for location specific ARARs in Subarea 4 where the STARS technology would be implemented in the floodplain (see STARS page 19). The agencies are evaluating the possibility of waiving compliance with ARARs that prohibit storage or disposal of tailings/contaminated soils in the floodplain on the basis that meeting the three criteria identified for use of the STARS technology with the floodplain (see STARS discussion on page 19) would attain a standard of performance (a level of protectiveness) equivalent to that required by floodplain and solid waste disposal ARARs. See 42 U.S.C. 121(d)(4)(D).

By removing contamination from the floodplain, the preferred alternative would meet the criterion of long-term effectiveness and permanence. For the most part, it would not change the mobility, toxicity and volume of contaminated media through treatment but would effectively reduce mobility of contaminants by placing excavated materials into secure regional repositories.

All alternatives that remove or treat the tailings/impacted soils exhibit some degree of short-term risk during implementation of the remedy, primarily related to potential accidents associated with transport of wastes. Alternative 6 could transport tailings/impacted soils by rail, as opposed to truck, thereby significantly reducing the chance of accidents involving workers or nearby residents during remediation.

Each of the alternatives is implementable with standard construction techniques. Removal of in-stream sediments is technically difficult, but is implementable.

With respect to cost effectiveness, Alternative 1 is the least costly to implement ($0.7 million to $1.4 million). Alternative 7 is the most costly to implement ($48 million to $79 million) (see Table 4). Total estimated costs for all the alternatives assume that the action will occur over a 3 to 7 year period with an operation and maintenance period of 30 years.

The State acceptance criterion is fulfilled because the state has identified the preferred alternative and EPA concurs with that alternative.

After the public comment period, MDHES and EPA will complete the evaluation of the alternatives with respect to the community acceptance criterion based on the public comments received.

MDHES and EPA believe that Alternative 6 represents the best balance of considerations using the selection criteria. This alternative would ultimately remedy soil, surface water, ground water, and in-stream sediment contamination. Most accessible tailings/impacted soils would be excavated and removed out of the 100-year floodplain, preventing this material from continuing to contaminate ground water and Silver Bow Creek.

Table 4

Total Volumes of Contaminated Materials Removed or Relocated and Cost

Alternative	Volume Relocated (cy)	Volume Removed (cy)	Cost (millions)
1	0	0	$0.7 - $1.4
2	0	0	$13 - $24
3	773,000	0	$21 - $40
4	0	943,800	$27 - $47
5	1,936,940	0	$32 - $55
6	0	1,936,940	$39 - $66
7	0	2,740,300	$48 - $79

The long-term effectiveness and degree of permanence of Alternative 6 is high. MDHES does not expect any unmanageable short-term risks associated with this alternative.

This remedy would comply with all applicable or relevant and appropriate requirements in Subareas 1-3. In Subarea 4, a waiver of location specific ARARs based on an equivalent standard of performance would have to be granted for the STARS technology to be applied in the 100-year floodplain. This remedy would be cost-effective.

CERCLA provides a clear preference for treatment which permanently and significantly reduces the volume, toxicity, or mobility of the hazardous substances. Off-site transport and disposal of the hazardous substances should be the least favored alternative where practicable treatment alternatives are available. See 42 USC 9621(b)(1).

MDHES and EPA have determined that the type of treatment available for the wastes at issue, developed through the STARS studies, will permanently and significantly reduce the toxicity or mobility of the hazardous substances only in those locations where it can reliably be maintained over the long term (see STARS discussion on page 19). Alternative 6 uses such treatment to the maximum extent practicable, since Alternative 6 includes such treatment for approximately one-third of the total volume of tailings/impacted soils (inside and outside of the 100-year floodplain), consisting of those located in those areas which can be adequately protected from erosion.

MDHES and EPA have determined that the proposed remedy satisfies the statutory requirements in Section 121(b) of the Comprehensive Environmental Response, Compensation and Liability Act, and that the proposed remedy:

- is protective of human health and the environment;
- complies with applicable or relevant and appropriate requirements or invokes suitable waivers;
- is cost effective; and
- utilizes permanent solutions and alternative treatment technologies to the maximum extent practicable.

The Nine NCP Criteria for Evaluation of Alternatives

"Threshold" Factors

Criteria which must be met.

1 Overall protection of human health and the environment addresses whether or not a remedy provides adequate protection and describes how potential risks posed through each pathway are eliminated, reduced or controlled through treatment, engineering controls or institutional controls.

2 Compliance with applicable or relevant and appropriate requirements (ARARs) addresses whether or not a remedy will comply with identified federal and state environmental or facility siting laws.

"Primary Balancing" Factors

The five criteria on which analysis is based.

3 Long-term effectiveness and permanence refers to the ability of a remedy to maintain reliable protection of human health and the environment over time.

4 Reduction of toxicity, mobility and volume through treatment refers to the degree that the remedy reduces toxicity, mobility and volume of the contamination.

5 Short-term effectiveness addresses the period of time needed to complete the remedy and any adverse impact on human health and the environment that may be posed during the construction and implementation period.

6 Implementability refers to the technical and administrative feasibility of a remedy, including the availability of materials and services needed to carry out a particular option.

7 Cost evaluates the estimated capital costs and operation and maintenance costs for 30 years.

"Modifying" Considerations

Are evaluated following comment on RI/FS and proposed plan and are addressed in the Record of Decision (ROD).

8 State acceptance indicates whether the State concurs with, opposes, or has no comment on the preferred alternative. However, for the Streamside Tailings Operable Unit, the State, as lead agency, has been involved in the identification and development of the preferred alternative. The State and EPA agree upon the remedy they propose in this plan.

9 Community acceptance is based on whether community concerns are addressed by the proposed remedy and whether or not the community has a preference for a remedy. MDHES and EPA balance community concerns with all of the other criteria. After the public comment period, MDHES and EPA will complete the evaluation of the alternatives in light of public comments.

How did MDHES determine where to apply the Streambank Tailings and Revegetation Study (STARS) technology?

A critical element of the remedy selection is the determination of which tailings may be left in place and treated with the STARS technology and which tailings must be removed from the floodplain. The STARS technology was developed under the oversight of MDHES in an attempt to create an alternative that could successfully be implemented within the floodplain. After evaluating STARS fully, MDHES identified certain criteria which define where within the flood plain STARS may effectively and reliably be implemented.

These criteria are:

1) The tailings/impacted soils involved are not saturated in groundwater during any part of the year.

The SST OU Remedial Investigation delineated the location and volumes of saturated tailings/impacted soils. Generally, ground water seasonally fluctuates slightly over two feet in the OU. Ground water movement into and out of tailings, even in STARS treated tailings, will cause continued contaminant migration to ground water.

2) STARS treatment must effectively immobilize the contaminants in the tailings/impacted soils.

The STARS study identified the ability of the technology to successfully immobilize most contaminants of concern where the amendments can be adequately mixed into the tailings and soils. The depth to which the necessary soil amendments can be effectively incorporated is limited. Moreover, because the STARS technology may not completely immobilize cadmium and zinc and may even increase the mobility of arsenic, a minimum thickness of native material between STARS treated tailings and ground water is needed to act as a buffer. A depth of tailings deposits thin enough that underlying native soils can also be tilled into the tailings is a positive consideration under this criterion.

3) The tailings/impacted soils are not located where they may be eroded and re-entrained into the creek system through normal stream processes or major flood events.

STARS treated tailings could be transported into the creek system if eroded during natural stream channel meander or flood events. Erosion and inundation from bank-full and flood events can be estimated based on a number of sources including CH2M Hill's Silver Bow Creek-Flood Modeling Study, which analyzes the lateral extent and water velocity of various flood events, from regular bank-full to greater flood events.

While the exact delineation of STARS-treated areas will be established during remedial design, these three criteria were used in analyzing each subarea to determine where STARS can be expected to effectively achieve protection of human health and the environment.

In Subarea 1, 67% of tailings/impacted soils are saturated. The confined nature of the floodplain and the steeper stream gradient in Subarea 1 increases the probability of adverse flood impacts on STARS treated area. The negative effects from saturated tailings, streambank erosion, and likely future overbank deposition of sediment on treated areas precludes implementing STARS in this subarea.

The evaluation of overall protection for Subarea 2 is the same as for Subarea 1 except for a considerable quantity of tailings/impacted soils which lie outside the 100-year floodplain. In the Ramsay Flats area, an estimated 240,000 cubic yards of tailings/impacted soils lie outside the floodplain. Because these tailings/impacted soils are located outside the 100-year floodplain, are generally unsaturated by ground water and are located above a rich organic soil horizon which helps attenuate metals movement, the application of STARS treatment in this defined area should meet remedial action objectives (RAOs).

Because of the confined nature of the floodplain in Subarea 3 (a relatively steep, narrow canyon), the analysis of these criteria is much the same as for Subarea 1. Overall protectiveness would be compromised by saturated tailings, streambank erosion, and likely future overbank deposition of sediment on treated areas, precluding implementation of STARS in this subarea.

In Subarea 4, the potential for flood impacts to STARS treated tailings is smaller as a result of the wide floodplain, which allows dispersion of stream energy to a much greater degree than in the upper three subareas. In addition, the presence of buried soils and, in many places, the separation of tailings from ground water is adequate to minimize the movement of metals through the vadose zone. Thus the potential effectiveness and reliability of STARS treatment is greater in this subarea than the other three subareas.

Public Comment

Public involvement has been an integral part of the Superfund process at the Streamside Tailings OU. MDHES will sponsor public involvement activities during public review and comment on this proposed plan and encourages the public to comment on this proposed plan and all other supporting documentation in the administrative record.

Public Comment Period for this proposed plan will be 60 days from June 9, 1995, through August 7, 1995.

Written Comments should be addressed to:

Jim Ford, State Project Officer,
Environmental Remediation Division,
Montana Department of Health
and Environmental Sciences,
PO Box 200901,
Helena, MT 59620-0901,
phone: 1-800-246-8198 (in-state)
or 406-444-1420.

Public Meetings at which MDHES will describe and answer questions on the proposed plan will be held at the following locations:

Fairmont
Fairmont Hot Springs Resort, Pintlar Room,
7:00 pm, June 20, 1995.

Butte
Butte Community Center
25 West Front Street,
7:00 pm, June 21, 1995.

Missoula
Room 201, Courthouse Annex
200 West Broadway,
7:00 pm, June 22, 1995.

Public Hearing to receive comment on the proposed plan will be held at:

Fairmont Hot Springs Resort, Pintlar Room,
7:00 pm, July 10, 1995.

During the public hearing, MDHES will accept formal verbal comment. MDHES will have a court reporter transcribe all comments and will respond to all comments received in the Record of Decision.

Site Document Repositories and Administrative Record

MDHES has maintained repositories for Clark Fork Basin documents since the mid-1980s. The repositories contain the major site documents upon which this proposed plan is based, including the SST OU RI/FS Administrative Order on Consent, the RI/FS Work Plan, all RI/FS Sampling and Analysis Plans, the 1991, 1992, and 1993 Data Summary Reports, Preliminary Remedial Action Objectives Report, Remedial Investigation Report, the Baseline Risk Assessment, and the Feasibility Study Report.

The document repositories are located at:

Anaconda	Hearst Free Library- 4th & Main Street
Bozeman	Montana State University- Renne Library
Butte	Silver Bow Library Montana Tech Library EPA Office CTEC office at Montana Tech
Deer Lodge	National Park Service- Grants-Kohrs Ranch Deer Lodge Public Library
Helena	MDHES Office, 2209 Phoenix Ave. EPA Office in the Federal Building State Library Montana Historical Society Library
Missoula	Missoula Public Library University of Montana- Mansfield Library Clark Fork PendOreille Coalition

EPA has a copy of the administrative record for the site at its office in Helena. The administrative record consists of the major documents described above and other specific documents relating to the site, including sampling results, correspondence, and reports, upon which the proposed remedy is based. A microfilm version of the administrative record is available at the Montana Tech library.

Key Concerns on Which MDHES and EPA Would Like Public Comments

All of the alternatives under consideration for cleanup of Silver Bow Creek have some risk associated with them, both long-term residual risk and short-term risk during construction.

MDHES has been meeting regularly with members of the public to understand better how they view the alternatives for cleanup. MDHES now requests specific comment on what the public considers to be acceptable long-term and short-term risks.

Public input on the following concerns is desired:

- What are your views on leaving tailings in the floodplain if such tailings are treated with the STARS technology?
- Which is preferable, many (15 - 30) local near-stream relocation repositories or one or two regional repositories?
- How do you feel about the use of presently uncontaminated areas for waste repositories?
- How important are land restrictions on relocation repositories?
- How would you feel about using Opportunity Ponds and/or a location up Browns Gulch for regional repositories?
- What are your feelings on the use of Ramsay Flats as a relocation or regional repository?
- How significant is the short-term risk of excavating and hauling waste materials to disposal sites in comparison with the long-term risks of creek contamination?
- What would be preferable, truck or rail haul to regional repositories?
- How would you feel about the use of size (less than 1mm) as the remedial criteria for in-stream sediment?
- What are your views of the remedial action objective of improving Silver Bow Creek to support a self-reproducing trout fishery?

MDHES and EPA staff available to the public

MDHES and EPA have technical and public involvement specialists working on the Streamside Tailings OU. MDHES will provide copies of past progress reports (newsletters for the public) upon request. MDHES and EPA personnel who will receive comments or supply additional information include:

Jim Ford, State Project Officer

Environmental Remediation Division, MDHES
P.O. Box 200901
Helena, MT 59620-0901
Phone: 800-246-8198 or (406)444-1420
FAX: (406)444-1901

Rosemary Rowe, RPM, or
Pam Hillery, EPA

U.S. EPA, Helena Office,
Region VIII, Montana Office
Federal Building, 301 South Park, Drawer 10096
Helena, MT 59626-0096
Phone: (406)449-5720 FAX: (406)449-5434

Are You on Our Mailing List?

If you wish your name to be added to or deleted from the mailing list for the Streamside Tailings Portion of the Silver Bow Creek/Butte Area Superfund site, or if you wish to update your address, please fill out, detach and mail the following form to:

Jim Ford
Montana Department of Health
and Environmental Sciences, Superfund
P.O. Box 200901
Helena, MT 59620-0901.

Name .... Affiliation (optional)

Address ....

City .... State .... Zip ....

☐ Remove from mailing list ☐ Change Address

Montana Department of Health
and Environmental Sciences, Superfund
P.O. Box 200901
Helena, MT 59620-0901.

1600 copies of this public document were published at an estimated cost of $0.75 per copy, for a total cost of $2,110, which includes $1,450 for printing and $660 for distribution.